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SCHMEISER, OLSEN & WATTS
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EXAMINER

TOBERGTE, NICHOLAS J

ART UNIT	PAPER NUMBER
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2823

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/11/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Period for Reply

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 January 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4 and 6-45 is/are pending in the application.
4a) Of the above claim(s) 16-30 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 44 and 45 is/are allowed.
- 6) ☒ Claim(s) 1,4,6-15,31-40 and 42 is/are rejected.
- 7) ☒ Claim(s) 41 and 43 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION***Response to Arguments***

Applicant's arguments filed 1/19/07 have been fully considered but they are not persuasive.

Applicants argue that Noble et al does not teach a reducing atmosphere. Applicants own specification states in paragraph [0025] that a reducing atmosphere is one of hydrogen or ammonia. Col.16 line 10 (Noble) states that adding hydrogen to the oxidizing atmosphere increases oxidation. Therefore, Noble does teach a "reducing atmosphere" (i.e. hydrogen as dictated by the Applicants specification) and it is present in the first chamber because it is used to increase oxidation (the oxidation is being done in the first chamber). Applicant's assertion that the gas wouldn't be present because of various valve placements and openings is not persuasive. Noble states starting on col. 16 line 10 that, *"Alternatively, the process gas may include a reactant gas mixture comprising two reacting gasses: a hydrogen-containing gas and an oxygen-containing gas that can be reacted together to form steam or water vapor at temperatures between 400-1250 degrees C. The hydrogen-containing gas may be hydrogen, or other hydrogen-containing gases such as, but not limited to ammonia..."*

This is a different embodiment as stated by Noble as being "alternative" and isn't necessarily shown in the drawings of the apparatus, but that in no way fails to teach that a reducing atmosphere is not present. Noble states that it is used and why from Col 16 lines 10 – 33.

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Applicants argument that Noble fails to teach an inert gas anywhere is not persuasive. Noble mentions helium throughout the disclosure, and indicates it as being an inert gas on Col 3 lines 57-60.

Pertaining to the Applicants arguments regarding claims 14 and 15. It has been shown that Noble does teach a reducing gas, and therefore renders the argument against optimization of parameters moot.

Pertaining to Applicants arguments regarding newly submitted claims 39, 40 and 42. Applicants state that Noble teaches that ions are eliminated before coming into contact with the SiO₂ layer. While this may be true, the newly submitted claims do not differentiate where in the process there are no ions. Applicants admit that Noble does teach generating ions (as all plasma processes generate ions of the gasses present) and eliminates them later. Newly submitted claims 39-43 fail to explicitly state that ions are present when the plasma comes into contact with the SiO₂ layer and as such they still read on Noble.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 4, 6, 7 and 31-38 are rejected under 35 U.S.C. 102(b) as being anticipated by Noble et al (US 6,450,116).

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Pertaining to claims 1 and 31, Noble teaches a method of fabricating a gate dielectric layer, comprising:

forming a silicon dioxide layer on a top surface of a substrate **Col 3 line 64**;

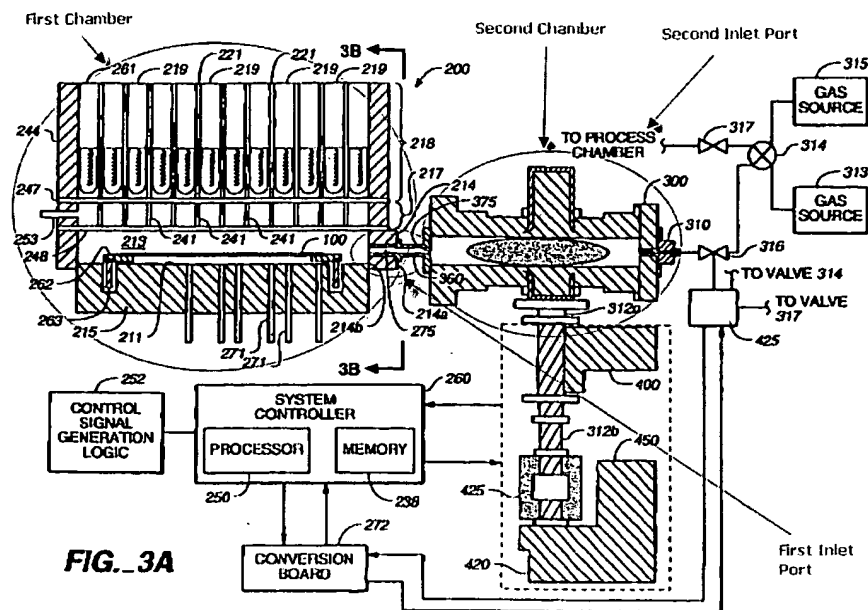
placing said substrate **100** in a first chamber **200** having a first inlet port **275** and a second inlet port (**See Figure 3A wherein the second inlet port is shown as being left of item 317 where it states "TO PROCESS CHAMBER"**);

generating a plasma in a second chamber **300**, said plasma comprising at least one nitridation species **Col 4 line 21**, said second chamber adjacent said first chamber **See Figure 3A**, said second chamber connected to said first chamber by said first inlet port **275** in said first chamber;

transferring said nitridation species of said plasma from said second chamber to said first chamber through said first inlet port **Col 3 lines 66-67** (in regards to claim 31, this is "exhausting"); and

performing a plasma nitridation in said first chamber using said nitridation species in a reducing atmosphere to convert said silicon dioxide layer into a silicon oxynitride layer **Col 4 line 9**.

The following is Figure 3A with the key components labeled.



Pertaining to claims 32 and 35, Noble teaches the method of claim 1, further including:

generating a nitrogen, inert gas and reducing gas plasma in said second chamber from nitrogen, an inert gas and a reducing gas; and

transferring said nitrogen, inert gas and reducing gas plasma from said chamber into said first chamber through said first inlet port of said first chamber. **Col 15 line 60 to Col 16 line 62**

Pertaining to claims 4 and 36, Noble teaches the method of claim 32, wherein said inert gas is helium **Col 3 line 57** and said reducing gas is hydrogen, ammonia, a mixture of hydrogen and nitrogen, a mixture of ammonia and nitrogen or a mixture of hydrogen, ammonia and nitrogen. **Col 16 lines 2-33**

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Pertaining to claims 33 and 37, Noble teaches the method of claim 32, wherein said inert gas is helium **Col 3 line 57** and said reducing gas is deuterium, deuterated ammonia, a mixture of deuterium and nitrogen, a mixture of deuterated ammonia and nitrogen, a mixture of deuterium, deuterated ammonia and nitrogen, or a mixture of deuterium, ammonia and nitrogen. **Col 16 lines 2-33**

Pertaining to claim 34, Noble teaches the method of claim 32, wherein said inert gas is helium and said reducing gas is hydrogen. **See rejection of claim 4**

Pertaining to claim 38, Noble teaches the method of claim 1, wherein said nitridation plasma is generated by radio frequency excitation. **Col 12 lines 4-47**

Pertaining to claim 6, Noble teaches a method of fabricating a gate dielectric layer comprising;

- providing a substrate;

- forming a silicon dioxide layer on a top surface of said substrate;

- performing a plasma nitridation in a reducing atmosphere to convert said silicon dioxide layer into a silicon oxynitride layer;

- wherein the step of performing a plasma nitridation is performed using plasma comprising nitrogen, an inert gas and a reducing gas, and

- wherein said inert gas is helium and said reducing gas is hydrogen.

See rejection of claim 1 and claim 34.

Pertaining to claims 39, 40 and 42, Noble teaches generating a plasma of "ions, radicals, and electrons" (Col 8 lines 54-62) in chamber **300 (second chamber)**. **Col 3 lines 55-67**

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 8-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Noble as applied to the claims above.

Noble teaches the methods above, but fails to particularly point out all the parameters involved. However, given the teaching of the references, it would have been obvious to determine the optimum thickness, temperature as well as condition of delivery of the layers involved. See *In re Aller*, Lacey and Hall (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation."

Note that the specification contains no disclosure of either the critical nature of the claimed ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a

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claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Any differences in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Applicants have the burden of explaining the data in any declaration they proffer as evidence of non-obviousness. Ex parte Ishizaka, 24 USPQ2d 1621, 1624 (Bd. Pat. App. & Inter. 1992).

An Affidavit or declaration under 37 CFR 1.132 must compare the claimed subject matter with the closest prior art to be effective to rebut a prima facie case of obviousness. In re Burckel, 592 F.2d 1175, 201 USPQ 67 (CCPA 1979).

Claim Objections

Claims 41 and 43 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Allowable Subject Matter

Claims 44 and 45 are allowed.

The following is an examiner's statement of reasons for allowance: The prior art does not teach nor suggest a method of fabricating a gate dielectric layer, comprising:

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forming a silicon dioxide layer on a top surface of a substrate; placing said substrate in a first chamber;

introducing a nitrogen containing gas, an inert gas and a reducing gas into a second chamber and generating a nitrogen, inert gas and reducing gas plasma in said second chamber;

transferring said plasma from said second chamber into said first chamber, nitrogen species in said plasma converting said silicon dioxide layer into a silicon oxynitride layer.

and;

a method of fabricating a gate dielectric layer, comprising:

forming a silicon dioxide layer on a top surface of a substrate;

placing said substrate in a first chamber;

introducing a nitrogen containing gas and an inert gas into a second chamber and generating a nitrogen and inert gas plasma in said second chamber;

simultaneously (i) transferring said plasma from said second chamber into said first chamber through a first inlet port connecting said first chamber to said second chamber and (ii) introducing a reducing gas into said first chamber through a second inlet port in said first chamber, nitrogen species in said plasma converting said silicon dioxide layer into a silicon oxynitride layer.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably

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accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

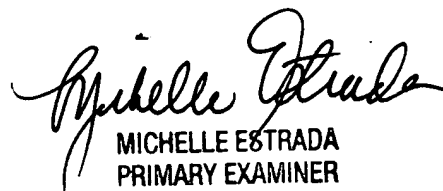
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicholas J. Tobergte whose telephone number is 571-272-6006. The examiner can normally be reached on Mon - Thur 7am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

NJT



MICHELLE ESTRADA
PRIMARY EXAMINER